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Geology Report

2019 Ranch Fire Pine Horse Valley Roadside Hazard Tree Abatement

Covering the following project area:

Upper Lake District

Pine Mountain, Horse Mountain and Deer Valley Areas

Upper Lake Districts, Mendocino National Forest

/s/ Signature on file

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1.1 Summary of Effects

Table 1 - Anticipated Proposed Action Effects with implementation of Project Design Criteria

Ranch Fire Pine Horse Valley Roadside Hazard Tree Abatement activities.

NI = negligible impact, NP = Not Present; PI = Potential Impact

<i>Resource</i>	<i>Impact</i>	Proposed Action Potential Effects
Caves Object of Interest in the BSMNM Cave resources are in Pine Horse Valley project area	NI	One cave resource is identified within the Pine Horse Valley project units. However, project activities would not physically impact the cave resources. Removal of mostly fire-killed or dying trees would have negligible impacts on cave environments as these trees no longer provide shade and evapotranspire.
Fossils Object of Interest in the BSMNM No known vertebrate localities; multiple invertebrate localities	NI	There would be negligible effects on fossil resources as there are no known localities in the projects units. There would be no major ground disturbing activities (such as road construction into bedrock) that could damage unidentified fossil resources.
Groundwater	NI	There would be negligible effects on groundwater resources (e.g., springs) as equipment are excluded by Design Criteria from these areas. There would be no major ground disturbing activities (such as road construction) that could intercept groundwater.
Minerals Access	NI	The project is partially in the Berryessa-Snow Mountain National Monument and the Monument is withdrawn from mineral entry. There are no known valid and existing claims in the area. There are no known claims outside of the National Monument and activities should not restrict access to minerals.
Slopes Unstable slopes are identified in the Pine Horse Valley project units. Unstable areas such as active landslides, earthflows, and other slopes	NI	Unstable areas were identified intersecting roadside units. Hazard trees that would be salvaged are dead or dying and, in the long term, no longer confer slope stability. Non-fire killed hazard trees may be felled on stable slopes. Key effects would be from skidding but design features forbid tractor skidding of felled hazard trees within unstable areas, including inner gorges. Landslides help convey large and coarse wood into stream courses; felled hazard trees may be left on naturally unstable slopes. There are no anticipated negative impacts on landslides with implementation of design features. The actions, with implementation of design features, would comply with the LRMP IV-33, #2.

<i>Resource</i>	Impact	Proposed Action Potential Effects
Naturally Occurring Hazardous Minerals/Serpentine Soils	NI	There are two mapped ultramafic areas within Pine Horse Valley HTA. One mapped area is in the Monument, and the other is not. To protect soil resources and public health, mechanical equipment will avoid these areas.
Bartlett Springs Fault Zone An area that is a Object of Interest in the BSMNM	NP	The Pine Horse Valley project area is outside of the known extent of the Bartlett Springs Fault Zone.
Snow Mountain An area that is an Object of Interest in the BSMNM	NP	The Pine Horse Valley project area does not include any part of the Snow Mountain area.

1.2 Geology Report

1.2.1 Executive Summary

The Ranch Fire Roadside Hazard Tree Abatement proposed action for the Pine Horse Valley project area was analyzed for effects on geologic resources and hazards. A large proportion of the project area is in the Berryessa-Snow Mountain National Monument. The categorically excluded project, with implementation of geologic design features, would have negligible or no effects on caves, fossils, groundwater, slope stability, and serpentine soils. Caves, fossils, groundwater and serpentine soils are Objects of Interest in the Berryessa-Snow Mountain National Monument. Key among the design features is the exclusion of mechanical equipment in unstable areas. There are two known serpentine soils in the Pine Horse Valley activity area. The majority of abated and/or salvaged trees would be dead or dying, thus actions are unlikely to impact soil moisture, soil strength, and slope stability in unstable areas. **With only negligible impacts for all geologic resources and hazards, there would be no extraordinary circumstances. The actions, with implementation of design features, would comply with the LRMP IV-33, #2: "Identify and evaluate areas of known or suspected instability as a part of project planning. Protect areas with a high probability of mass wasting from ground disturbing activities." Other geologic features were reviewed for consistency with the Berryessa-Snow Mountain National Monument Objects of Interest and as required by Forest Service Manual 2880.**

1.2.2 Introduction

The purpose of this document is to disclose effects on geologic resources and hazards within the 2019 roadside hazard tree abatement project in the Pine Horse Valley area (Upper Lake District).

The Categorically Excluded roadside hazard abatement projects are on the Mendocino National Forest and the Berryessa-Snow Mountain National Monument.

Discussions include current conditions (the affected environment) and disclosures on foreseeable environmental effects based on the proposed action and project design features.

With project design features, the proposed action would cause no extraordinary circumstances and the project would follow the LRMP with respect to geologic resources and hazards.

Geologic resources and hazards analysis include potential impacts to slope stability, groundwater, changes to cave environments (if any in project areas), impacts to paleontological resources (if any in project areas) and others. Mineral access is also considered.

1.2.3 Proposed Action

Refer to the decision memo for the complete proposed action and for all project design criteria.

1.2.3.1 Existing Information Used for this Report

- For Unstable Area identification, required by the MNF LRMP:

- Mendocino National Forest and Region 5 Corporate GIS Library, including: R5 MNF bedrock (for ultramafic areas) and geomorphology compilations for ultramafic bedrock and previously mapped but not verified active landslides
- NRCS Gridded Soil Survey Geographic (gSSURGO) for potential serpentine soil areas
- Hillshaded FEMA 2016 Lake county Lidar Digital Elevation Model for the entire Upper Lake district and portions of the Grindstone district
- Aerial and Satellite imagery, including: 2016 digital NAIP imagery and 1969 Air Photos
- 2018 Ranch Fire Geology Burned Area Emergency Response Assessment Survey 123 Data
- Forest Service/USGS 7.5-minute topographic maps

A combination of LiDAR and aerial imagery was used to confirm if a landslide in the GIS geomorphology layer is present, and if so, it was re-mapped using high resolution LiDAR. The same data was used to map previously unidentified landslides. Landslides that appear fresh, with sharp topographic features and/or rough, hummocky terrain, were mapped as active landslides. In areas where there is no LiDAR, aerial imagery and existing mapping was used. See **Appendix A** – Map for identified unstable areas.

1.3 Current Conditions

The project area is within the 2018 Ranch Fire on the Mendocino National Forest. All the Pine Horse Valley project area is within the Berryessa-Snow Mountain National Monument (referred to as Monument in the rest of this document).

1.3.1 Caves

Caves are an Object of Interest in the Monument. Cave resources are identified within the project area. None of these cave resources are recorded as Significant Caves under the Federal Cave Resources Preservation Act of 1988.

1.3.2 Fossils

Fossils are an Object of Interest in the Monument. There are no known fossil localities in the project areas.

1.3.3 Groundwater

In a post-wildfire environment with mass tree mortality, it is expected that groundwater levels are elevated. Increased occurrences of seeps and springs are expected, and in fact, have been observed immediately post-fire.

1.3.4 Landslides

2016 FEMA LiDAR of Lake County shows that most project roads avoid steep terrain and active landslides. Many roads are on ridges, which are usually more stable than at midslope location. Many unstable areas were identified in the Pine Horse Valley project area activity polygons.

The Ranch Fire has a greatly increased the risk of landscape-wide new or accelerated mass wasting. The reason for this is due to a massive vegetative mortality. Live vegetation removes water from the ground via evapotranspiration. Furthermore, vegetation can have extensive root networks, which stabilize soil. With widespread vegetation mortality, evapotranspiration is reduced, and roots die. Reduced evapotranspiration results in elevated groundwater and, coupled with dead and decaying roots (over the next several years), reduces root support of soils thereby affecting soil strength (stability), which increases the likelihood of landslides (Ziemer, 1981). Winter storms are a common trigger of landslides on the Mendocino National Forest. Dormant landslides do not have strong evidence of present movement. These are common within the project area.

1.3.5 Serpentine Soils

Ultramafic soils or serpentine soils are an Object of Interest in the Monument. There is one mapped area of ultramafic bedrock within the Monument portion of the Pine Horse Valley hazard tree abatement units. However, the gSSURGO does not have any serpentine soil areas, or Henneke soil series, mapped within project units. There one more mapped area of ultramafic bedrock in the project but it is outside of the monument in the Pine Mountain units. It also was not mapped as a serpentine soil area in gSSURGO. gSSURGO lists graywacke, sandstone, and shale as parent material of soils throughout the project units.

1.4 Design Features

See the Regulatory Framework section for LRMP standards and guides that these design features implement.

- Prohibit all ground-based mechanical equipment entry into active landslides and inner gorges (unstable areas). Inner gorges are 65% and greater slopes immediately adjacent to stream beds. They extend up slope until a slope break where slopes are less than 65% or at ridge top.
- Minimize ground disturbances (such as gouging or rutting) in unstable areas.
- Minimize use of ground-based mechanical equipment on road cuts greater than 35% slope.
- Construct landings where hillslopes and fills would remain stable.
- Minimize using ground-based equipment in serpentine soil areas. Minimize airborne naturally occurring asbestos by avoiding skidding or dragging of vegetative materials through serpentine soils (see map attached to the Geology report).
- Project workers should read, understand, and implement the Job Hazard Analysis on Naturally Occurring Asbestos prior to working in ultramafic rock or serpentine soil areas

1.5 Analysis of the Proposed Action's Effects

This analysis is inclusive of design features.

1.5.1 Caves

Negligible impact.

- No caves would be altered by project activities. Hazard trees may be abated near outcrops with caves, but most hazard trees are fire-killed. Fire-killed trees no longer provide shade and no longer evapotranspire. Sparse green hazard trees may be removed near outcrops with cave potential, but that activity should be rare and would have negligible impacts on cave environments. Refer to the wildlife report for any applicable wildlife design features.

1.5.2 Fossils

Negligible impact.

- There are no known invertebrate or vertebrate fossils in the project unit polygons. Fossils are unlikely to be destroyed by the proposed action as no excavation into rocky areas or bedrock would occur.

1.5.3 Groundwater

Negligible impact.

- Due to landscape-wide tree mortality, hazard tree abatement would not cause a measurable change in groundwater. Mechanical equipment would avoid wet areas.

1.5.4 Landslides

Negligible impact.

The actions, with implementation of design features, would comply with the LRMP IV-33, #2: "Identify and evaluate areas of known or suspected instability as a part of project planning. Protect areas with a high probability of mass wasting from ground disturbing activities."

- Most hazard trees would be dead or dying, thus the proposed action would not additionally reduce evapotranspiration or reduce root support. Therefore, abatement of hazard trees would not increase landslide risk.
- Green hazard trees may be abated, but compared to fire-killed trees, the activity would be rare. These trees can only have a high hazard potential on road cuts and in unstable riparian reserves, thus helping to preserve evapotranspiration and soil root support.
- Mechanical equipment would avoid slopes above 35% except where it is reasonable to skid up to 100ft on those slopes. This reduces ground disturbance in steeper areas, thereby helping to protect existing slope stability.
- Hydrology Best Management Practices and design features (see PIF for design features and BMPs) include ground cover and hydrological stabilization requirements. These design features and BMPs would protect slope stability in stable areas disturbed by

mechanical equipment. Roads would be repaired post-haul to help maintain stability of adjacent hillslopes.

- In unstable riparian reserves, ground-disturbing yarding of abated hazard trees would be minimized. Ground equipment is prohibited from operating in unstable areas. Only equipment positioned on a road can remove abated trees, using a grapple or full suspension yarding, from unstable riparian reserves. This protects unstable areas from ground disturbance but allows removal of hazards near roads. Avoidance of unstable areas is "the most effective and cost-efficient method of managing landslide-prone terrain" (Chatwin, Hogan, & Schwab, 1994). Prohibiting ground equipment in unstable areas helps to preserve existing hydrologic pathways and soil stabilizing understory.
- Aquatic Conservation Strategy objectives would thus be met by minimizing ground disturbing activities in unstable areas and, incidentally, potentially reducing long-term post-fire fuel loading.
- Project activities are not expected to increase the risk of landslides thus public safety is not expected to be impacted.

1.5.5 Serpentine Soils

Negligible impact.

1.5.6 Serpentine Soils

Negligible impact.

When severely disturbed, such as by mining or logging, serpentine soil and vegetation recovery can be very slow (Harrison, Safford, Grace, Viers, & Davies, 2006). Therefore, design features include avoidance of serpentine soil areas.

- There are two known ultramafic areas within the Pine Horse Valley hazard tree abatement units. One is in the Monument and the other is not. To protect ultramafic soils, design features minimize mechanical entry into these areas.

1.6 Regulatory Framework

The Mendocino National Forest Land and Resource Management Plan (LRMP). The LRMP provides objectives, standards and guidelines for implementing the NFMA on the Mendocino National Forest. Consistency with standards and guidelines occurs with the Proposed Action's Design Criteria and/or BMPs. The LRMP standards and guides for soils and geology (page IV-33) requires that unstable areas be identified and protected from ground disturbing activities.

Design features are required to follow the LRMP Standards and Guides and the Northwest Forest Plan Aquatic Conservation Strategy.

The following standards and guides from the MNF LRMP support this project's design features:

- For unstable areas:
 - LRMP IV-30 #3 states "As a general rule, standards and guidelines for riparian reserves prohibit or regulate activities in riparian reserves that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Watershed analysis and appropriate NEPA compliance is required to change riparian reserve boundaries in all watersheds."
 - LRMP IV-30 #3(a)5 includes unstable areas (including earthflows) and inner gorges as riparian reserves under the Aquatic Conservation Strategy.
 - LRMP IV-33, #2: "Identify and evaluate areas of known or suspected instability as a part of project planning. Protect areas with a high probability of mass wasting from ground disturbing activities."
 - For roads, landings and slope stability:
 - S&G IV-19 #5 states, "Meet aquatic conservation strategy objectives for each existing or planned road."
 - S&G IV-19 #5(a) states "minimize road and landing locations in riparian reserves."
 - S&G IV-19 #5(e) states " minimize disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow."
 - S&G IV-19 #8 states, "Route road drainage away from potentially unstable channels, fills, and hillslopes"
 - For groundwater resources:
 - LRMP IV-30 #1 states "Manage National Forest lands to meet the following Aquatic Conservation Strategy Objectives"
 - LRMP IV-30 #3 states " As a general rule, standards and guidelines for riparian reserves prohibit or regulate activities in riparian reserves that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Watershed analysis and appropriate NEPA compliance is required to change riparian reserve boundaries in all watersheds."
 - LRMP IV-30 #3(a)5 includes wetlands less than 1 acre as a riparian reserve.
-

Forest Service Manual (FSM). Title 2800 provides directives for the management of mineral activities, planning and protection of geologic resources and management of geologic hazards on National Forest System lands. FSM 2880 requires integration of geologic resources and hazards into NEPA processes.

Federal Cave Resources Protection Act of 1988. This act provides that Federal lands be managed to protect and maintain, to the extent practical, significant caves.

Paleontological Resources Preservation Act of 2009. This act provides that paleontological resources are protected using scientific principals and expertise. The Forest Service promulgated its Final Regulations for Paleontological Resources Preservation at Title 36 Code of Federal Regulations (CFR) Part 291.

Record of Decision and the Standards and Guidelines for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan). Defines and emphasizes management of riparian reserves, to include unstable areas.

1.7 References

Chatwin, S. C., Hogan, D. L., & Schwab, J. W. (1994). *A guide for management of landslide-prone terrain in the Pacific Northwest* (2nd ed.). Victor, i, a: British Columbia Ministry of Forests.

Harrison, S., Safford, H. D., Grace, J. B., Viers, J. H., & Davies, K. F. (2006, 2). REGIONAL AND LOCAL SPECIES RICHNESS IN AN INSULAR ENVIRONMENT: SERPENTINE PLANTS IN CALIFORNIA. *Ecological Monographs*, 76, 41-56.
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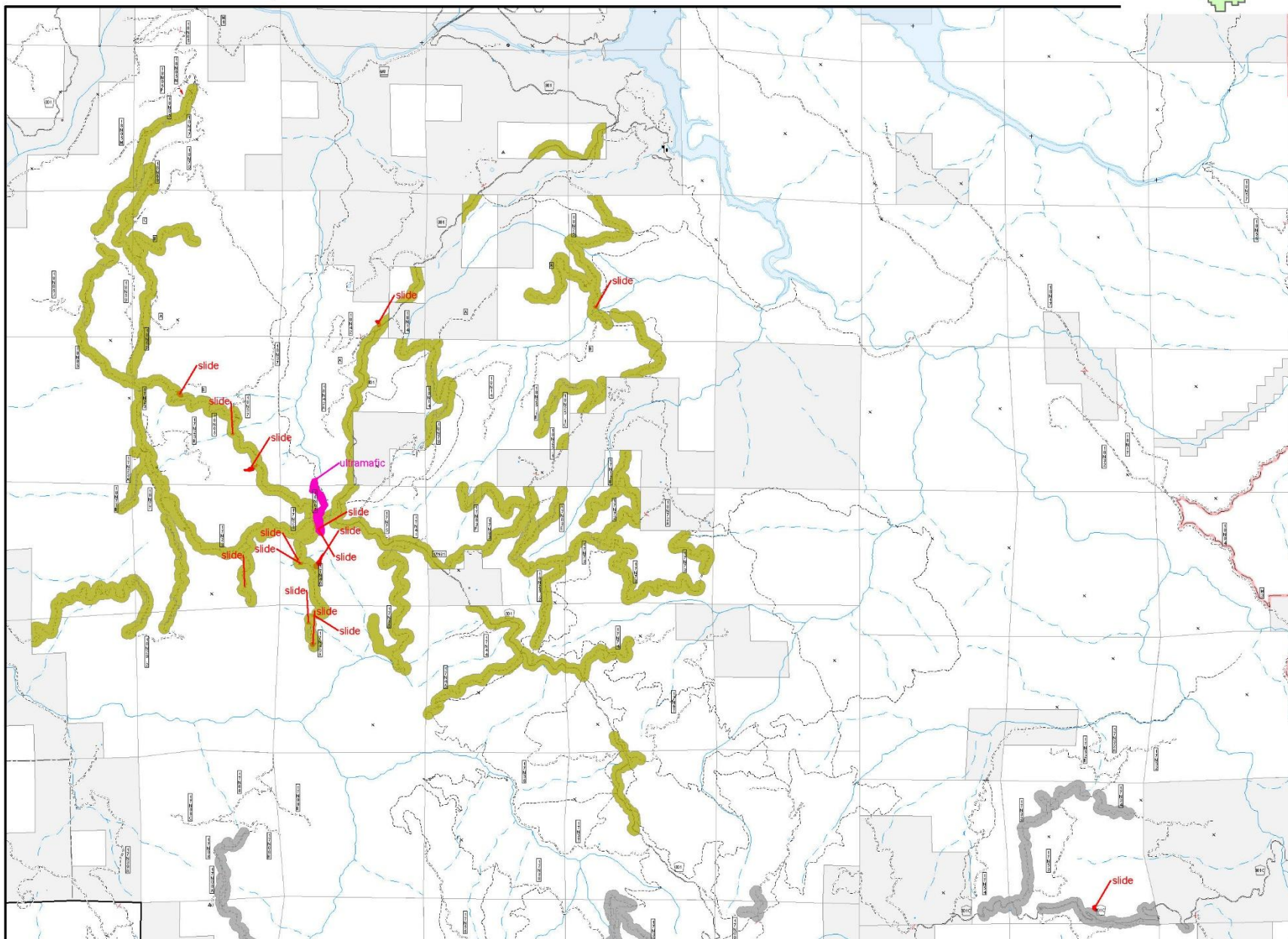
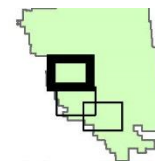
Ziemer, R. R. (1981, 9). The Role of Vegetation in the Stability of Forested Slopes. *Proceedings of the XVII International Union of Forest Research Organizations, I*. Retrieved from <https://www.fs.usda.gov/treesearch/pubs/8693>

Appendix A – Map

Maps of identified unstable riparian reserves and ultramafic areas are on the following page. These mapped areas are subject to modification or removal based on the professional judgement of the project geologist.

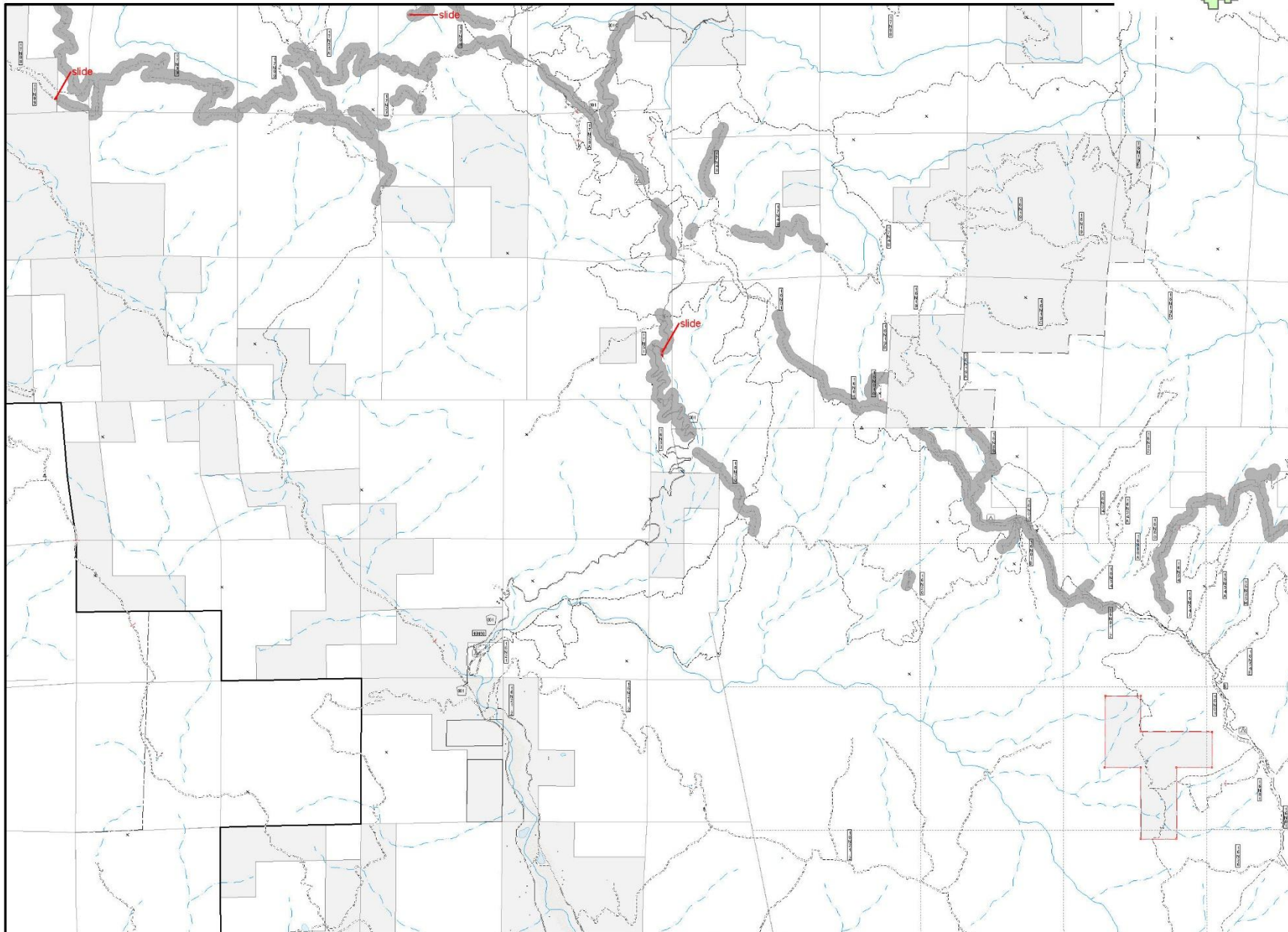
Roadside Hazard Abatement Identified Unstable Riparian Reserves

- Pine Mountain
- Unstable Riparian Reserves
- Deer Valley-Horse Mountain
- Mapped Ultramafic or Serpentine Area



Roadside Hazard Abatement Identified Unstable Riparian Reserves

Deer Valley-Horse Mountain Unstable Riparian Reserves



Roadside Hazard Abatement Identified Unstable Riparian Reserves

- Deer Valley-Horse Mountain
- Mapped Ultramafic or Serpentine Area

